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NE2000plus Installation

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NE2000plus Installation Guide

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chapter 1

NE2000plus Overview

This manual contains a brief introduction to the NE2000plus family of Network Interface Boards for Ethernet. Three versions of the NE2000plus are available. The NE2000plus-3 (part number 810-228-001) shown in Figure 1-1, the NE2000plus (part number 810-228-002) shown in Figure 1-2, and the NE2000Tplus (part number 810-228-003) shown in Figure 1-3.

The manual also provides installation, configuration, and diagnostic procedures and network planning, cabling, and troubleshooting instructions.

Multiple Media Access Options

The NE2000plus-3 has interface capabilities for Unshielded Twisted-Pair (UTP), Coaxial, and AUI type connectors. The NE2000plus has interface capabilities for Coaxial and AUI type connectors. The NE2000Tplus has interface capabilities for Unshielded Twisted-Pair.

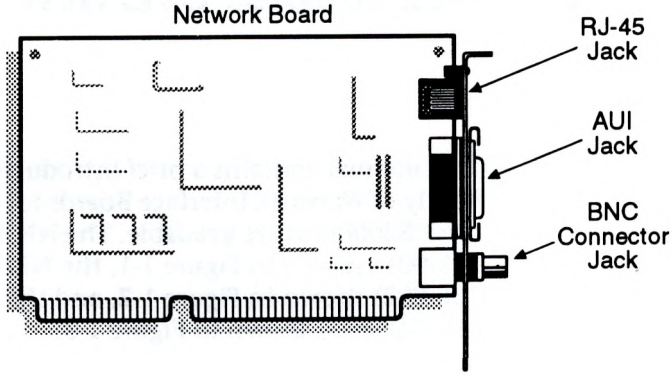
NE2000plus Network Interface Boards are software configurable NE2000 series compatible boards. The NE2000plus-3 and the NE2000plus boards default to the BNC type connector. The NE2000plus family of boards can use the same LAN driver as the NE2000 and NE2000T boards. All three boards default to port 300h and IRQ 3. The NE2000plus family of boards provide the ability to attach a network station to 10Base-2, 10Base-5, 10Base-T, or StarLAN-10 networks. See Figures 1-1, 1-2 and 1-3.

Note

Polarity and Link status lights only have meaning when using UTP cabling. The Link status light will be continuously lit when using StarLAN-10 networks.

Note The term NE2000plus is used throughout the manual to refer to all 3 board types unless a specific reference to a specific board is needed.

Figure 1-1
NE2000plus-3 Multiple Media Access Options



Note When using default options the board can be installed directly out of the box as long as no other board is set for port 300h and IRQ 3. Configuration is necessary only when using non-default options.

Figure 1-2
NE2000plus Coaxial and AUI Options

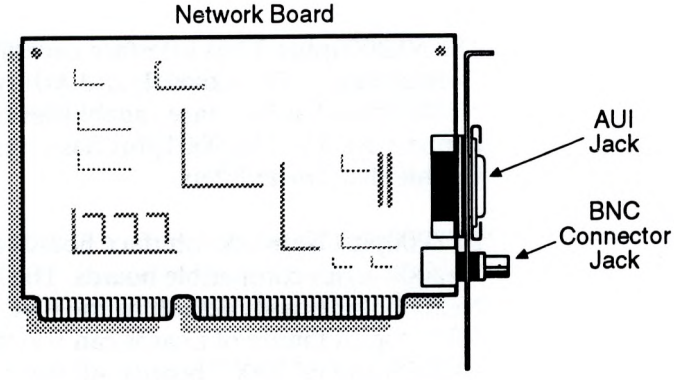
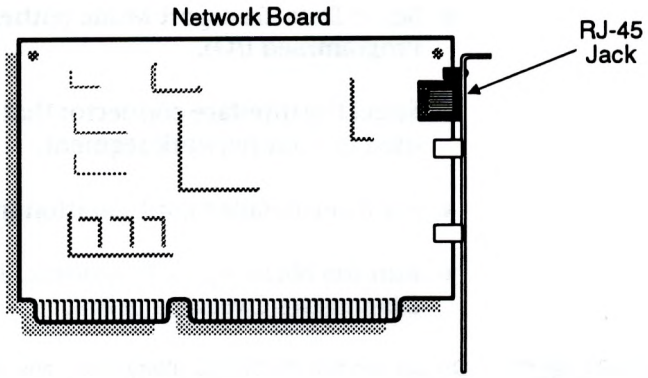


Figure 1-3
NE2000Tplus Unshielded Twisted-Pair Option



The NE2000plus is configured with a menu-driven user configuration program provided by Novell and requires no hardware jumper settings before installation. It can be installed in ISA or EISA bus computers by following the installation instructions included with the NE2000plus and the computer.

Installation Overview

- Install and configure one NE2000plus at a time.
- Run NE2000plus configuration software if using non-default parameters. See the Configuration Overview below.
- See chapter 2 for installation examples and more detailed information.

Configuration Overview

- Install and configure only one NE2000plus at a time. Configure the board using port 300h and IRQ 3 last to prevent conflicts.
- Run the NE2000plus user configuration/diagnostics utility (PLUSDIAG.EXE) provided if changing the configuration.
- Select "Change Configuration."
- Select an IRQ option, I/O port, and ROM address that does not conflict with another board or device in the computer.

- Select Data Transport Mode (either Shared Memory or Programmed I/O).
- Select the interface connector that matches the cable type being used in your network segment.
- For more detailed configuration information see chapter 3.
- Run the NE2000plus Diagnostics if necessary. See the Diagnostics Overview below.

Do not run the PLUSDIAG utility when any driver is loaded.

Diagnostics Overview

- Run the NE2000plus user configuration/diagnostics utility (PLUSDIAG.EXE) provided with the Network Interface Board.
- Select the board to be tested if more than one NE2000plus is installed in the computer.
- Select "Run Diagnostics" from the menu.
- Select a test option from the list displayed on the monitor.
- See chapter 4 NE2000plus Diagnostics for more detailed information.

chapter 2

NE2000plus Installation

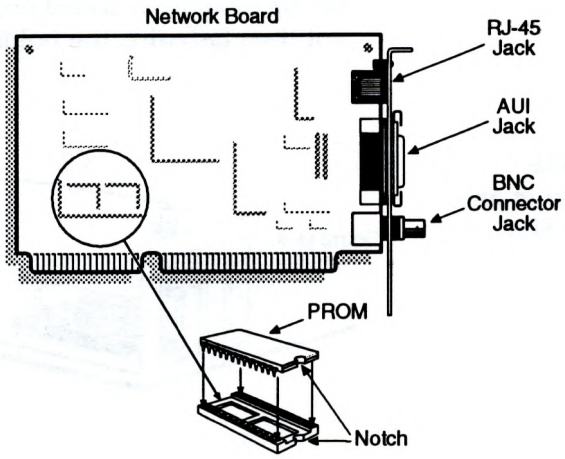
The NE2000plus board can be installed in ISA or EISA bus computers. An EISA configuration file, !NVL1501.CFG, for the NE2000plus is provided to be used when installing the board in EISA bus computers.

Important

Two configuration programs are used when installing the NE2000plus in EISA computers, EISACONFIG (for the computer) and PLUSDIAG (for the NE2000plus). Make sure the EISA configuration port address and IRQ in the computer configuration match the ones in the NE2000plus configuration.

Install a Remote Boot (Remote Reset) PROM, if needed, as shown in Figure 2-1. Then continue the installation process. If a Remote Boot PROM will not be used, continue the installation process as explained in Installing the Board.

Figure 2-1
Installing a Remote Boot PROM



Remote Boot PROMs are enabled during user configuration. User configuration is explained in chapter 3.

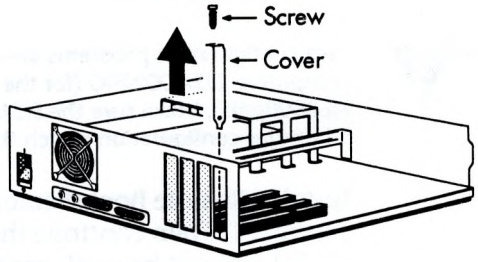
Installing the Board

1. Before starting NE2000plus board installation, turn off the system power.

2. Remove the computer cover.

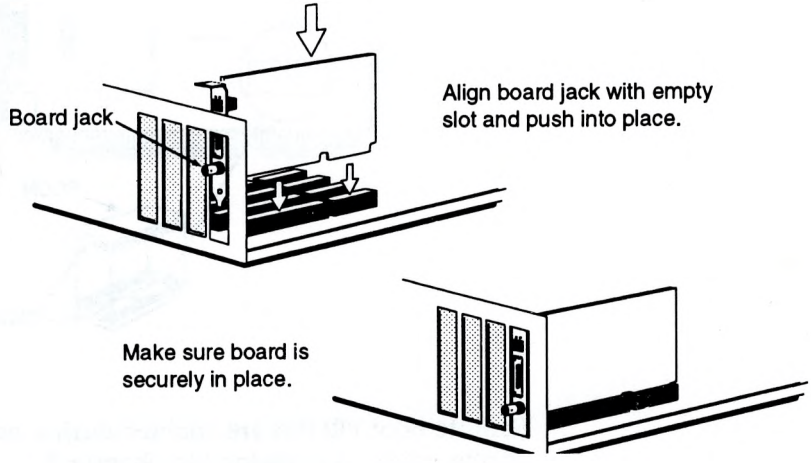
3. Remove the expansion slot cover bracket for the slot where the board will be installed. See Figure 2-2.

Figure 2-2
Removing the Expansion Slot Cover Bracket



4. Insert the NE2000plus board into the expansion slot. Make sure the NE2000plus is seated properly by pressing it firmly into the slot then fastening the holding screw. See Figure 2-3 .

Figure 2-3
Inserting the NE2000plus in an Expansion Slot



The configuration program does not need to be used if only one board is being used with default settings. When installing more than one NE2000plus, each board should be installed and configured before installing additional boards. The board being used with default options should be installed last.

5. Configure the board if not using default options.
6. Install and configure additional NE2000plus boards as needed.
7. Reinstall the computer cover.

Refer to chapter 3 Configuring the NE2000plus for more detailed configuration instructions.

chapter 3

Configuring the NE2000plus

This section provides guidelines for configuring the NE2000plus board. The board is configured with the user configuration utility (PLUSDIAG.EXE) and has no hardware jumpers. If you are using the default configuration the board may be used without running the NE2000plus configuration utility.

Do not run the PLUSDIAG utility when any LAN driver is loaded.

Running User Configuration Software

Multiple boards should be installed and configured one at a time with the last board using the default configuration parameters.

If a boot PROM is installed, the correct option parameters must be selected each time the configuration program runs or the PROM will be disabled.

NE2000plus configuration can be done from either a fixed disk or a floppy disk. Insert the NE2000plus disk in a floppy drive and copy the files to the fixed disk, or type PLUSDIAG at the A: or B: prompt then press <ENTER> to start the configuration program.

The network station monitor displays a list of all previously installed NE2000plus boards and the Ethernet node address for each NE2000plus board.

Changing the Configuration

When a LAN board is selected, the current configuration is displayed. Options to either "Change Configuration" or "Run Diagnostics" are also displayed.

Select "Change Configuration" to display the Configuration Options list.

Configuration Options

The Configuration Options screen displays parameters that can be changed if the default options are not suitable.

- I/O Address (controls base I/O Port Address selection).
- Interrupt (controls Interrupt Request Line selection).
- Connector Type (select BNC, AUI, or UTP connector types).
- Transport Mode (controls Programmed I/O or Shared Memory selection).
- ROM Address (controls Boot PROM Memory mapping).
- Timing compatibility (controls computer-NE2000plus timing).

A list of the default board options is shown below.

Table 3-1
Default Options

Default Parameter	Default Setting
Base I/O Address	Port 300h
Interrupt	IRQ 3
Connector Type	BNC (NE2000plus & NE2000plus-3)
	UTP (NE2000Tplus)
Data Transport Mode	Programmed I/O
Boot PROM	Disabled

I/O Address Options

A list of possible port addresses will be displayed on the monitor when this option is selected. Port 300h is the default base I/O address for the NE2000plus. If another board or device in your computer conflicts with the NE2000plus, change the option on the NE2000plus or the other device to prevent a conflict.

Table 3-2
I/O Address Options

I/O ports						
300h,	320h,	340h,	360h,	240h,	280h,	2C0h

Interrupt Options

A list of possible interrupt options will be displayed on the monitor when this option is selected. The default Interrupt Request Line is IRQ 3. If another board or device in your computer conflicts with the NE2000plus, change the option on the NE2000plus or the other device to prevent a conflict.

The program automatically detects used interrupts and reconfigures the board for an unused interrupt.

Table 3-3
Interrupt Options

Interrupts			
IRQ2,	IRQ3,	IRQ4,	IRQ5,
IRQ10,	IRQ11,	IRQ12,	IRQ15

A list of interface connector type options will be displayed on the network station monitor when this option is selected.

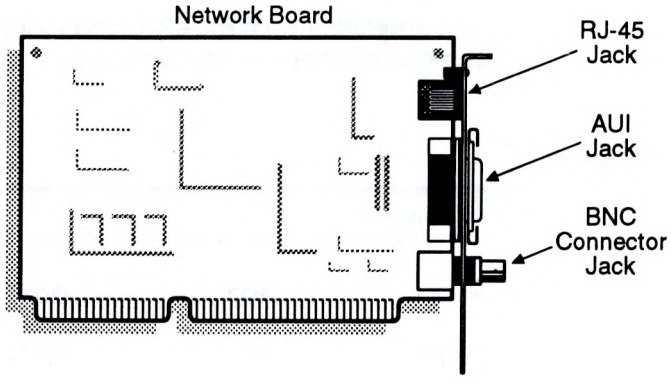
The NE2000plus can be configured for one of four Network topologies. Thin Ethernet is the default option. If your network cabling is one of the other types, highlight the required option and press <ENTER>.

- Thin Ethernet (50 ohm coax, BNC, or 10Base-2 networks).
- Thick Ethernet (AUI port or 10Base-5 networks).
- Twisted-Pair Ethernet (10Base-T networks).
- Twisted-pair Ethernet (Starlan-10 networks).

10Base-T and Starlan-10 Ethernet networks use the same RJ-45 connector on the NE2000plus.

Figure 3-1 shows the hardware interface options.

Figure 3-1
NE2000plus-3 Hardware Interface Options



See chapter 5 Planning the Network and chapter 6 Cabling the Network for detailed Ethernet specifications and cabling information.

Data Transport Mode

A list of possible data transport options will be displayed on the monitor when data transport mode is selected. An I/O port base address must be selected whether using programmed I/O or shared RAM. The I/O options are listed in the I/O Address Options section.

Shared RAM will provide better performance than programmed I/O.

Eight bit memory devices mapped between C000:0h and DFFF:Fh will conflict with the NE2000plus in sixteen bit shared RAM mode using a Basic Option. If such a device is installed, choose an Extended Option if possible. This also applies when using boot PROMs.

Table 3-4
Basic Shared RAM Address Options.

Basic Options			
C000:0h,	C400:0h,	C800:0h,	CC00:0h,
D000:0h,	D400:0h,	D800:0h,	DC00:0h

The Shared RAM Options are set in the AUTOEXEC.NCF file for NetWare server and in the NET.CFG for DOS ODI workstation and OS/2 drivers. Extended Shared RAM address options will not work with Remote boot PROMs

Table 3-5 lists Extended Shared RAM Options available when using protected mode LAN drivers (for example, NetWare server and OS/2 drivers).

Table 3-5
Extended Shared RAM Address Options.

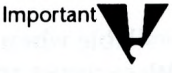
Extended Options			
E0000:0h,	E2000:0h,	E4000:0h,	E6000:0h,
E8000:0h,	EA000:0h,	EC000:0h,	EE000:0h,
F0000:0h,	F2000:0h,	F4000:0h,	F6000:0h,
F8000:0h,	*FA000:0h,	*FC000:0h,	*FE000:0h

The last three options in the table (marked with an asterisk) may conflict with system memory that has been remapped to these addresses.

The extended shared RAM options cannot be used in systems with more than 14 Mb of RAM. If your system has more than 14 Mb of RAM, options from the Basic Options table must be used.

If the Basic and Extended Options conflict with the current system setup, the NE2000plus should be run in programmed I/O mode.

Boot PROM Address



If a boot PROM has not been installed, do not select a boot PROM address. Errors can occur if a boot PROM address is selected and a PROM is not installed.

The NE2000plus default setting for the boot PROM is disabled. If the ROM is enabled and another board or device in your computer uses the default setting, change the option on the NE2000plus or the other board to prevent a conflict.

There are two different versions of the boot PROMs. Table 3-6 refers to the original boot PROM and Table 3-7 refers to the enhanced

remote boot PROM. One of the following options must be used if the original remote boot PROM is installed:

Table 3-6
Boot PROM

Option	IRQ	I/O Port	Memory Address	Frame Type
1	3	300h	C800:0h	Ethernet 802.3
2	4	340h	D000:0h	Ethernet II
3	5	320h	CC00:0h	Ethernet 802.3

One of the following options can be used if the enhanced remote boot PROM is installed:

Table 3-7
Enhanced Boot PROM

PROM Address	IRQ	I/O Port
C800:0h	*	300h
CC00:0h	*	320h
D000:0h	*	340h
D400:0h	*	360h
D800:0h	*	240h
DC00:0h	*	280h

Timing Compatibility Controls

A list of timing compatibility control options will be displayed on the network station monitor when this option is selected.

Do not change the following parameters unless timing compatibility issues arise.

- I/O 16 Control.
- I/O Timing Compatibility.

I/O 16 CONTROL

I/O 16 Control Normal is the default setting for most computers. This sets the board for standard 16 bit "AT Compatible" bus timing.

I/O 16 Control Late is an optional setting that makes the board timing compatible with computers using VLSI brand chips. For example, IBM PS/2 Model 30 computers use VLSI chips.

I/O Timing Compatibility

This option is the software equivalent of the W16 jumper on the NE2000 and NE2000T boards. It allows bus timing compatibility between the NE2000plus and computers such as those using the Chips and Technologies chip sets.

Normal Channel Ready is the default setting for most computers. This sets the board for standard "AT Compatible" bus timing.

Early Channel Ready is an optional setting that makes the board timing compatible with the following computers:

Compaq portable
IBM 286/30
Computers using the Chips and Technologies chip sets

Exiting the Program

When you have completed the configuration, press <ESC> to exit. Configuration changes are saved automatically when exiting.

Test the board configuration by running the user configuration program again and selecting the "Run Diagnostics" option from the main screen.

To make boot PROM settings effective the computer must be cold booted.

Refer to chapter 4 NE2000plus Diagnostics for more detailed diagnostic information.

chapter 4

NE2000plus Diagnostics

This chapter provides guidelines for running NE2000plus user diagnostics.

Running User Diagnostics

Do not run the PLUSDIAG utility when any driver is loaded.

NE2000plus diagnostics can run from either a fixed disk or a floppy disk. Insert the NE2000plus disk in a floppy drive and copy the files to the fixed disk or type PLUSDIAG <ENTER> from the A: or B: prompt. Diagnostics are self explanatory. If you discover a problem that cannot be resolved, refer to chapter 8 Troubleshooting Hints.

Press <ESC> to back out of any screen or exit the program.

The program displays all NE2000plus boards installed in the workstation and the Ethernet Node Address for each LAN board.

When a LAN board is selected, the current configuration for that board is displayed. Options to either "Change Configuration" or "Run Diagnostics" are also displayed.

Select "Run Diagnostics" to display the Diagnostics Options list.

A detailed list of Diagnostics Options will be displayed on the network station monitor.

The Diagnostics Options screen displays the list of parameters that can be tested on the NE2000plus board,

- Auto Test.
- Communications Loopback Test.

- I/O Read/Write Test.
- Interrupt Test.
- Random Access Memory Test.
- Shared Memory Test.
- Transfer Test.

The workstation LAN driver software must not be loaded before running diagnostics except on the workstation running PING for the Transfer test.

Auto Test

"Auto Test" performs the "Interrupt test", "I/O Read/Write test", "Shared Memory test", and the "Random Access Memory test." The tests performed will be displayed on the left side of the monitor and the results of the test will be displayed on the right side. A message will also be displayed if a test fails.

Communications Loopback Test

This test sends a packet out on the selected media and then tests to see if the packet is returned successfully.

Note

Do not run the Communications Loopback test unless a loopback connector is installed. A twisted pair loopback connector can be built by using a male RJ-45 connector and wiring pin 1 to pin 3 and pin 2 to pin 6. The Communication Loopback test can run on an NE2000plus board configured for Thick or Thin Ethernet by properly terminating the Thick or Thin connector.

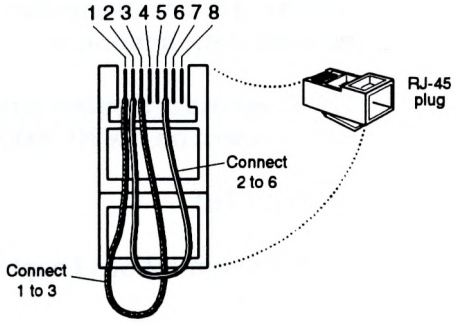


Figure 4-1
Communications Loopback connector.

I/O Read/Write Test

This test writes information to the I/O port then reads the data back to see if it is correct.

Interrupt Test

This option tests the IRQ selected during configuration. The IRQ is captured and generated for this test.

Random Access Memory Test

This test writes a bit pattern to each memory location then shifts the data through all 8 bits. The test also verifies that the data was written correctly.

Shared Memory Test

This test first checks for available shared memory then writes a random bit pattern if memory is available. The data is then verified.

If shared memory is not available a message is displayed stating that the test will not be executed.

Transfer Test

This test requires PING to be running on a DOS ODI workstation with the 802.2 frame type loaded.

All valid Ethernet packet sizes are tested. The Transfer test sends 1 packet at a time and waits for a reply (up to 1455 packets can be sent), therefore, testing the communications link.

Novell's drivers default to the 802.2 frame type. The 802.2 frame type must be used on the workstation running the PING utility. The frame type can be set to 802.2 for older ODI drivers in the NET.CFG file on the workstation. PING cannot be used with a dedicated IPX driver. PING is used by first loading the ODI drivers in their normal order and then running PING.

When any test option is successfully executed, a success message will be displayed. If the test fails, an error message will be displayed in the Test Results window.

Refer to chapter 5 Planning the Network for more detail on Ethernet specifications and limitations.

chapter 5

Planning the Network

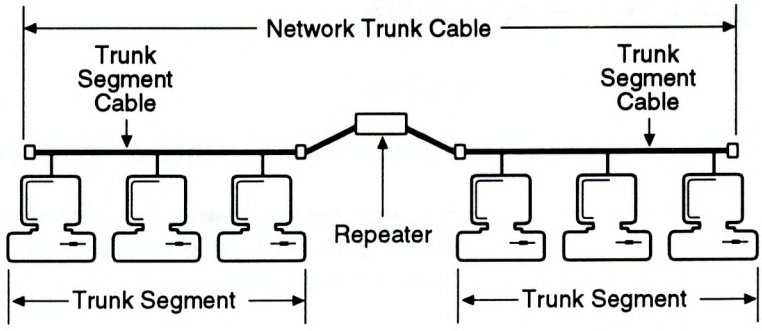
Planning the Network

This section,

- Explains common Ethernet network terminology.
- Explains the hardware and cable requirements for thin-cable, thick-cable, UTP-cable and combination thin/thick/UTP-cable Ethernet networks.
- Explains how to design your own network layout and make sure that you have all the hardware necessary to set up your own network.
- Explains common Ethernet network terminology.

Ethernet networks consist of several network stations connected together to allow electronic communication between stations. Network stations can be file servers, bridges, print servers, network stations or other nodes on the network. The network stations on a thin or thick network are connected at intervals to one long main cable, referred to as the trunk segment cable. The network stations and the main cable together form a trunk segment. See Figure 5-1.

Figure 5-1
Ethernet Network Components



The thin-Ethernet trunk segment cable is usually made up of a series of cable lengths connected with connectors, rather than one continuous cable.

The trunk segment is limited to a maximum length and a maximum number of stations that can be accommodated. However, a network can be expanded beyond one trunk segment by linking two or more trunk segments together with a repeater.

A repeater forms a pathway for network signals traveling from one trunk segment to another; it also amplifies network signals.

The network trunk cable is the sum of all the trunk segment cables. Just as a trunk segment cable is the backbone of a trunk segment, the network trunk cable is the backbone of the entire network.

Cable Types

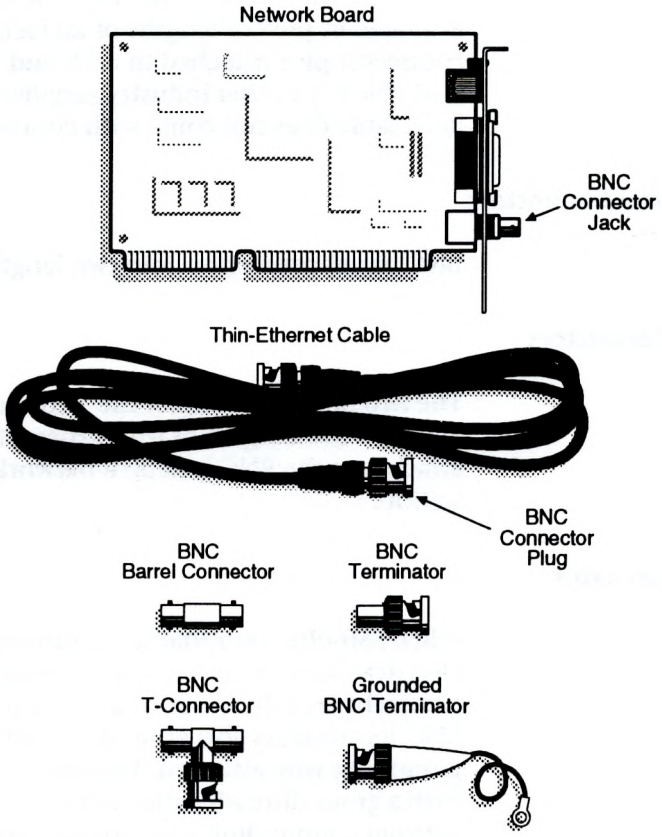
There are three kinds of Ethernet cable, thin-Ethernet coaxial cable (type RG-58 A/U), thick-Ethernet coaxial cable, and UTP-Ethernet cable.

These kinds of Ethernet cable can be used to build a wide variety of Ethernet cabling systems. Each type is explained in more detail in the next few pages.

Thin-Ethernet Cable Network Hardware

The hardware needed to set up a thin-Ethernet cable network is shown in Figure 5-2.

Figure 5-2
Thin-Ethernet Cable Network Hardware



Network Board

A network board is a printed circuit board. Network boards are inserted into an expansion slot in each network station and cabled together to allow electronic communication between network stations.

BNC Connectors

BNC jacks and plugs connect network hardware. The BNC jack on a network board connects the board to the trunk segment cable. The BNC plugs, at each end of thin-Ethernet cable lengths, connect the cable to T-connectors, barrel connectors, and other hardware.

Thin-Ethernet Cable

Thin-Ethernet cable is type RG-58A/U 50-ohm coaxial cable. It is available in pre-cut lengths of 20 feet, with a standard BNC connector plug attached to each end. Thin-Ethernet cable is also available from other industry suppliers in bulk quantities; however, bulk cable does not come with connectors attached.

BNC Barrel Connectors

BNC barrel connectors join two lengths of thin-Ethernet cable.

BNC T-Connectors

The two opposing jacks of the T-connector act as a barrel connector and join two lengths of thin-Ethernet cable. The remaining plug attaches to the BNC jack on a network board installed in a network station.

BNC Terminator

A BNC 50-ohm terminator "terminates" the network and absorbs electrical interference on the network. It is attached to one of the two jacks on a T-connector at the end of a trunk segment. Some BNC terminators also ground the network; these come with a grounding wire attached. You must use BNC terminators (one end with a grounding wire attached as shown in Figure 5-3, and one end without a grounding wire) to properly install an Ethernet network.

Thin-Ethernet Cable Network Layout

Below is a summary of the limitations and rules for thin-Ethernet cable networks. See Figure 5-3.

Limitations

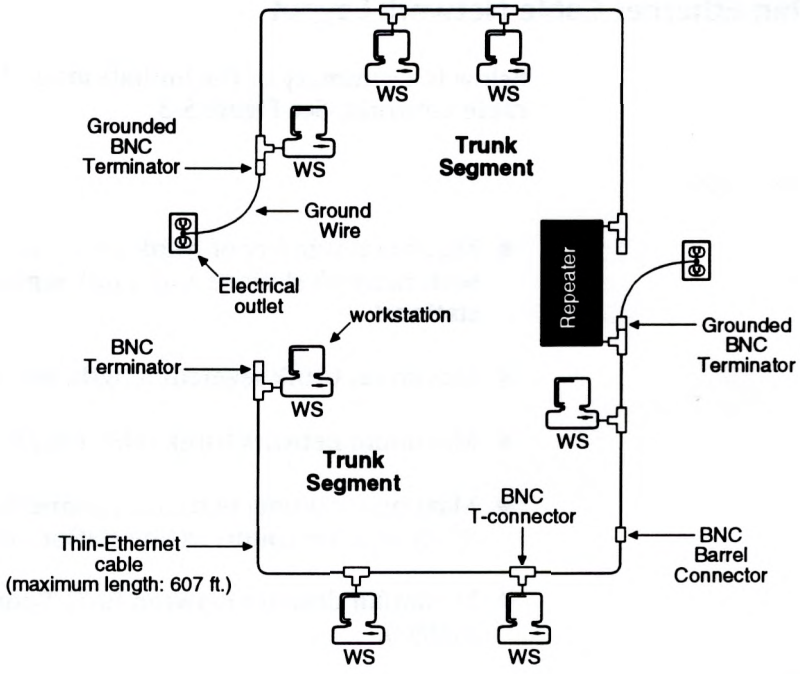
- Maximum number of trunk segments: 5 (3 coaxial segments with network stations and 2 link segments without network stations).
- Maximum trunk segment length: 607 feet (185 meters).
- Maximum network trunk cable length: 3,035 feet (925 meters).
- Maximum number of stations connected to one trunk segment: 30 (A repeater counts as one station on a trunk segment).
- Minimum distance between BNC T-connectors: 1.6 feet (0.5 meters).

Rules

- A BNC terminator must be attached to each end of each trunk segment. One of the two terminators on each segment must be grounded.
- Barrel connector splices should be kept to a minimum. Use unspliced cable lengths between network stations wherever possible. The fewer connections you make in the cable, the more reliable the network will be.

If you are sure you will never require a network trunk cable over 3,035 feet (925 meters) long, you may want to use thin-Ethernet cable, because this type of cable is less expensive and easier to install than thick-Ethernet cable.

Figure 5-3
Thin-Ethernet Cabling Example



Thick-Ethernet Cable Networks

Thick-Ethernet Cable Network Hardware

The hardware needed to set up a thick-Ethernet cable network is described below. Each piece is illustrated in Figure 5-4.

Network Board

A network board is a printed circuit board. Network boards are inserted into each network station and cabled together to allow network stations to communicate.

Transceiver

Stations on a thick-cable network communicate with the network through external transceivers attached to the trunk segment cable. External transceivers are required only when thick-Ethernet cable is

used. Any standard Ethernet external transceiver (IEEE 802.3) can be used on a thick-cable network.

Transceiver Cable

The transceiver cable connects stations to external transceivers on a thick-cable Ethernet network.

DIX Connectors

A DIX connector plug and a DIX connector socket are attached to either end of a transceiver cable. The DIX plug (characterized by several small pins) connects to a network board that has been installed in a network station. The DIX socket connects to an external transceiver.

Slide Lock

A slide lock secures the connection between a transceiver cable and a network board installed in a station.

Thick-Ethernet Cable

Thick-Ethernet cable is large diameter 50-ohm coaxial cable and is available in various pre-cut lengths with a standard N-series connector plug attached to each end; it can be purchased from an authorized NetWare dealer. Thick-Ethernet cable is also available in bulk quantities. However, bulk cable does not come with connectors attached.

N-Series Connector Plugs

An N-series connector plug is installed on each end of a thick-Ethernet cable. See Figure 5-4.

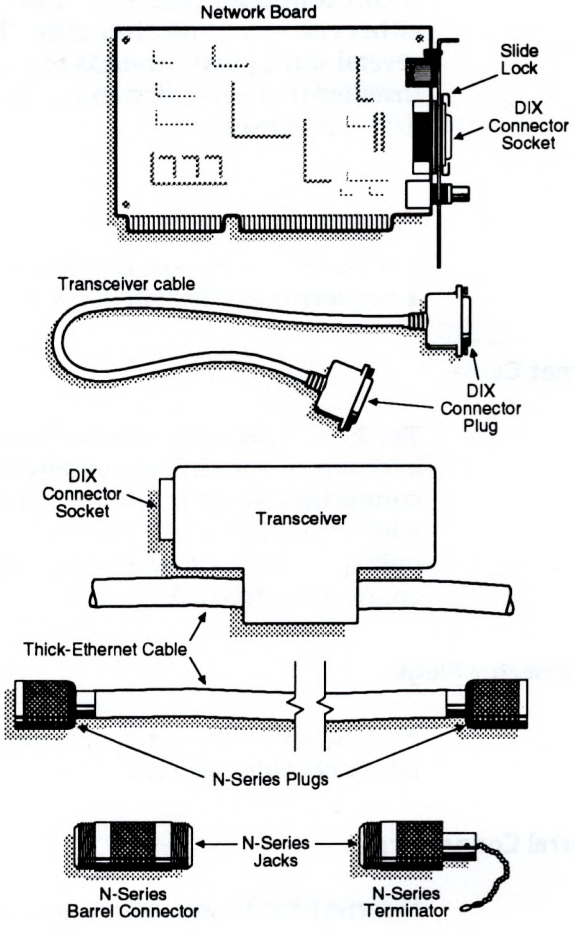
N-Series Barrel Connectors

N-series barrel connectors join two lengths of thick-Ethernet cable.

N-Series Terminators

An N-series 50-ohm terminator "terminates" the network and absorbs electrical interference on the network. It is attached to an N-series male connector on one end of a thick-Ethernet cable. Some N-series terminators also ground the network; these come with a grounding wire attached. You must use an N-series terminator at each end of the cable; however, only one end of the cable must be earth grounded.

Figure 5-4
Thick-Ethernet Cabling Hardware



Thick-Ethernet Cable Network Layout

Below is a summary of the limitations and rules for thick-Ethernet cable networks. See Figure 5-5.

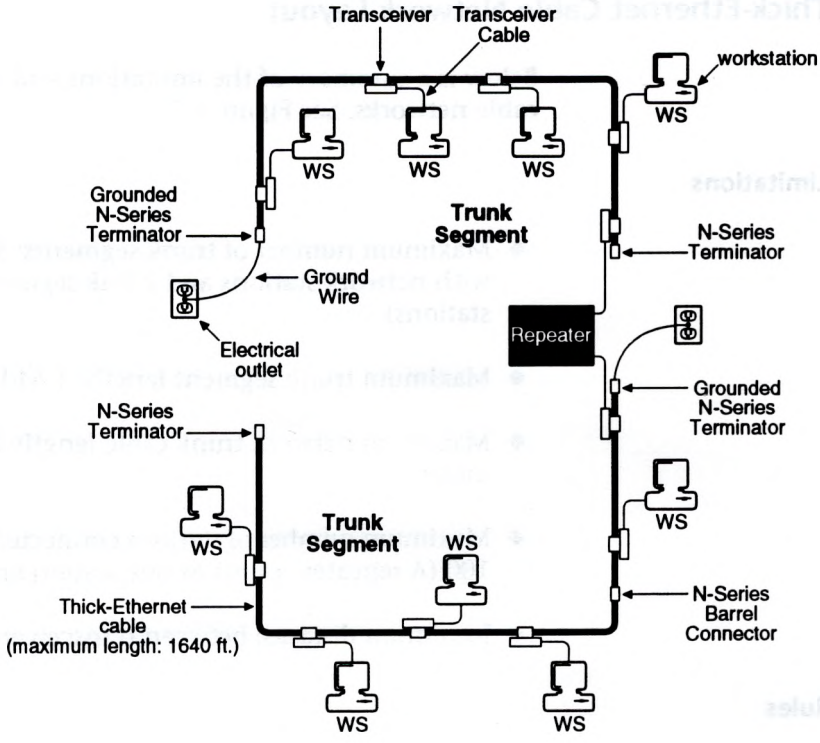
Limitations

- Maximum number of trunk segments: 5 (3 coaxial segments with network stations and 2 link segments without network stations).
- Maximum trunk segment length: 1,640 feet (500 meters).
- Maximum network trunk cable length: 8,200 feet (2,500 meters).
- Maximum number of stations connected to one trunk segment: 100 (A repeater counts as one station on a trunk segment).
- Minimum distance between transceivers: 8 feet (2.5 meters).

Rules

- A terminator must be attached to both ends of each trunk segment. One of the two terminators on each segment must be grounded.
- Barrel connector splices should be kept to a minimum. Use unspliced cable lengths between network stations wherever possible. The fewer connections you make in the cable, the more reliable the network will be.

Figure 5-5
Thick-Ethernet Network Cabling Example



Combination Thin/Thick-Cable Network Layout

This section describes how to combine thin and thick cable within a single trunk segment, using as much thin cable as possible. (See Figure 5-7 for an example of a Combination Thin/Thick-Ethernet Cable Network Layout.)

- You can join a thin-cable trunk segment to a thick-cable trunk segment with a repeater. Up to five dissimilar trunk segments (using four repeaters) can be joined in this way. To create this kind of network, build each trunk segment according to the instructions in the "Thin-Ethernet Cable Network Layout" and "Thick-Ethernet Cable Network Layout" sections in this chapter. When both segments are built link them together with repeaters as described in the "Cabling the Network" chapter.

- You can use both thin and thick cable within the same trunk segment. To build this kind of trunk segment, continue by reading the next section.

Combination Thin/Thick-Cable Hardware

Thin/thick-cable networks use the same networking hardware as thin-cable and thick-cable networks. In addition, however, you need to use adapters to create the combination trunk segments. Two kinds of adapters are,

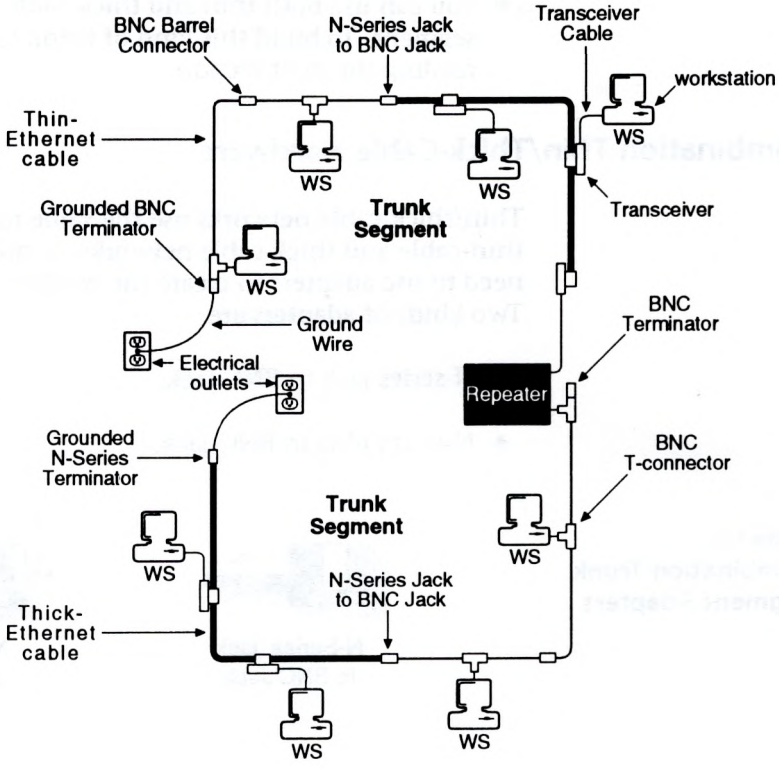
- N-series jack to BNC jack.
- N-series plug to BNC jack.

Figure 5-6
Combination Trunk Segment Adapters

N-Series Jack to BNC Jack

N-Series Plug to BNC Jack

Figure 5-7
Combination Thin/ Thick-Cable Network Example



Combination thin/thick-cable trunk segments are between 607 feet and 1,640 feet long. The minimum length is 607 feet because trunk segments shorter than 607 feet can be built with thin cable exclusively.

To find the maximum amount of thin cable you can use in one combination trunk segment, use the following equation:

$$\frac{1640 \text{ feet} - L}{3.28} = t$$

(L = length of the trunk segment; t = the maximum length of thin cable that can be used)

For example, if you want to build a trunk segment that is 1,500 feet long and you want to minimize the cost of hardware, use the following equation to determine the maximum length of thin cable you can use:

$$\frac{1640 \text{ feet} - 1500 \text{ feet}}{3.28} = 43 \text{ feet}$$

You could use up to 43 feet of the less expensive thin cable. You would then use thick cable for the remaining 1,457 feet of cable required in the trunk segment.

Note The maximum number of trunk segments that can be connected together is five.

UTP Network Hardware

This section includes a description of networking hardware and provides guidelines for connecting a UTP network station segment.

Note 10Base-T networking products allow considerable flexibility in making interconnections to coaxial and fiber-optic cable systems. For a large cable system, comply with AT&T Premises Distribution System (PDS) guidelines.

Network Board

A network board is installed in each network station (including servers, routers, and workstations). The NE2000plus has an RJ-45 connector jack on the board's mounting bracket to provide a network cable connection.

Cable

The 10Base-T standard allows the use of 22, 24, and 26 gauge unshielded twisted-pair (UTP) cable, although 24 AWG is most common. Voice and data lines should be in separate sheaths. Consult your reseller for information about testing the cable as you install the cable system.

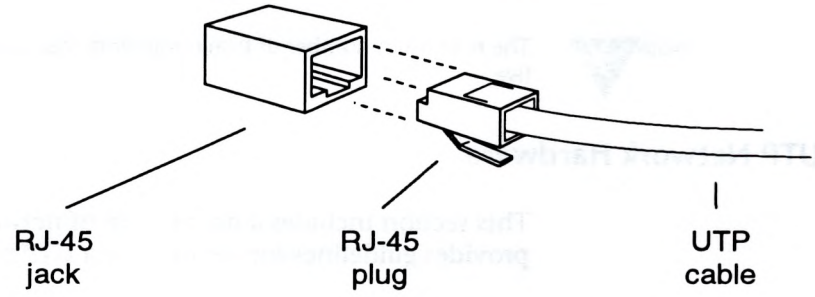
Important

If your site is wired in compliance with the older Uniform Service Order Code (USOC) standards, split-pair wiring problems can occur. If you are using existing wiring, make sure the site is not wired in compliance with the USOC standard.

RJ-45 Jacks and Plugs

Both ends of UTP cable segments have RJ-45 (8-wire, 4-pair) plugs, See Figure 5-8. One RJ-45 plug is inserted into the RJ-45 jack on the board's mounting bracket. The other RJ-45 plug is inserted either into an RJ-45 modular jack wall plate or into an RJ-45 port on a UTP concentrator or hub, as required by your cabling scheme.

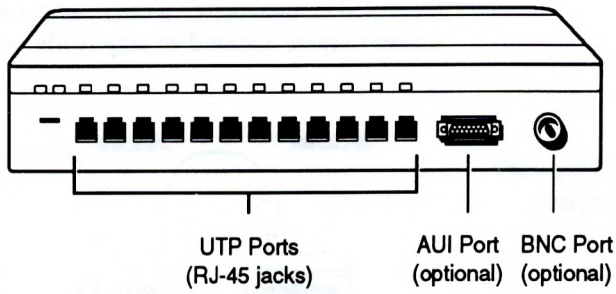
Figure 5-8
RJ-45 Jack and Plug



Concentrator (Multiport Repeater)

The concentrator (Figure 5-9) is the hub of a star-configured segment. A concentrator provides UTP ports (RJ-45 jacks) for connecting network stations with UTP cable links. Many concentrators also provide AUI or BNC ports that allow you to daisy-chain concentrators or connect to thick-Ethernet or thin-Ethernet segments. Some concentrators have internally terminated BNC ports so an external terminator is not required.

Figure 5-9
UTP Concentrator



A concentrator can also be connected to a station through a punch down block and RJ-45 modular wall plate. For more information, consult the documentation that accompanied the concentrator.

Network Layout

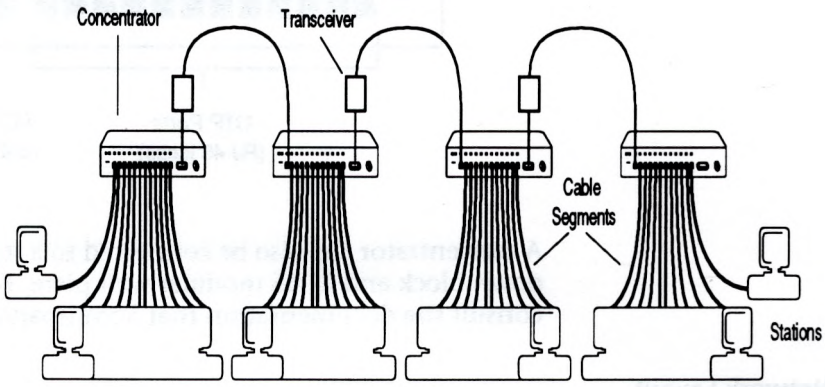
The following limitations apply to a UTP cable network:

- Maximum cable run length (station to concentrator): 328 feet (100 meters).
- Some higher grade cables allow longer runs. Consult your reseller or cable vendor.
- Maximum number of stations on a system (concentrators are not counted): 1024.
- Maximum number of daisy-chained concentrators on one network segment: 4.

Important Only three of the five cable segments can be coaxial.

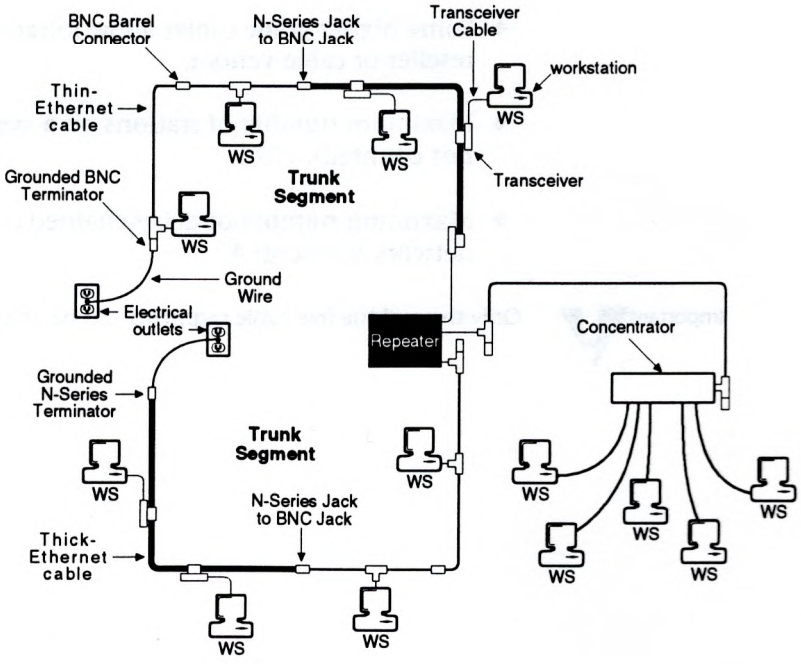
Figure 5-10 illustrates a daisy-chained UTP network segment. The server can be located at any node you choose.

Figure 5-10
UTP Cable Network Segment Layout



Combination UTP/Thin/Thick-Cable Network Layout

Figure 5-11
Combination UTP/Thin/Thick-Cable Network



Planning the Network Layout

Evaluating Network Needs

Now that you know the limitations of different Ethernet cabling schemes, consider the following questions as you define your particular network needs:

- How large an area must the cabling system cover?
- How many trunk or UTP segments will best suit the physical layout of the site?
- How many network stations (file servers, bridges, and workstations) will be connected to the cabling system?
- How far apart will the network stations be?
- What potential growth in size and number of connections must the system accommodate?

Drawing the Network Plan

Draw your network plan, labeling each piece of hardware that will be included (such as stations, cables, transceivers, repeaters, concentrators, and terminators). Keep in mind the rules given in the preceding sections and,

- Measure the distances between all components to make sure they fall within the appropriate parameters. Make sure to measure the actual route for the cable to get an accurate length.
- Ensure that the locations you choose for file servers have adequate room for any peripherals (such as printers or external disk drives) that will be attached.

See chapter 6 Cabling the Network for more detailed cabling information.

chapter 6

Cabling the Network

Cabling Network Stations

Now that you have installed and configured each network board, you are ready to cable all network stations together. This section explains how to cable a thin-Ethernet cable network, a thick-Ethernet cable network, a thin/thick-Ethernet cable network, and a combination UTP/thin/thick cable network.

Follow the guidelines below as you install your cable network:

- Turn off each network station.
- Install one trunk segment at a time if you are installing more than one.
- Do not crimp the cable, damage its insulation, or run the cable near heat sources or fluorescent light fixtures, or in heavy traffic areas where hand trucks or rolling chairs might damage it.

Cabling a Thin-Ethernet Cable Network

The order of the steps you follow to assemble each trunk segment is not important. For example, you could place your network stations and peripherals first. Then, you could create your trunk segment cable(s). (Figure 6-1 illustrates a thin-Ethernet cable trunk segment.) Finally, you could connect the T-connectors directly to the BNC connector jacks on the network boards installed in each station.

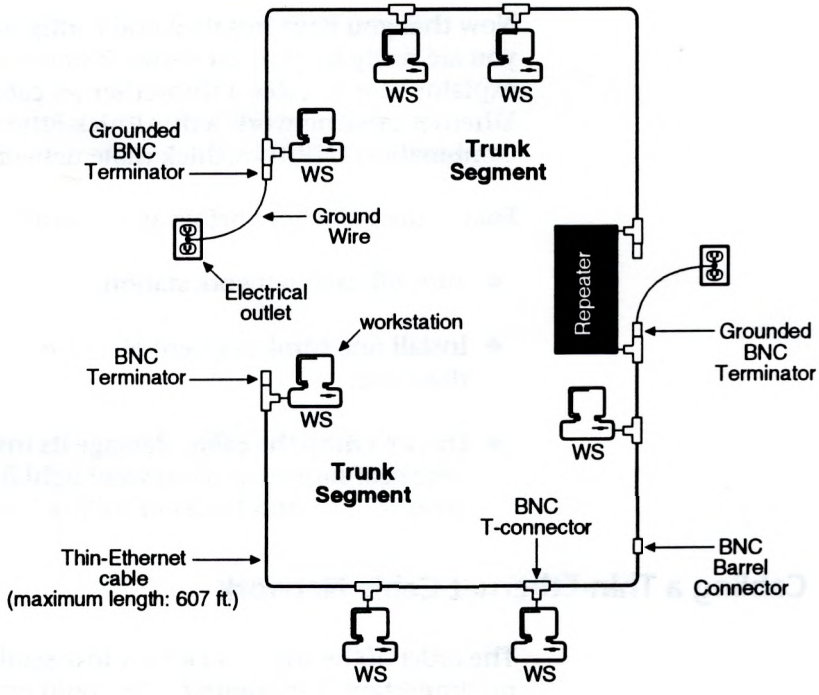
Similarly, you could place your network stations and peripherals first, attach a T-connector to each network board in each station, and then connect the T-connectors together with cables.

Remember to attach a BNC terminator to each end of the trunk segment. One of these terminators should have a grounding wire

attached. Attach the end of the grounding wire to an earth ground (the middle screw of an AC outlet). If the grounding wire is too short to reach the outlet, use 16- or 18-gauge insulated wire to extend the grounding wire.

Trunk segments are connected to each other with repeaters. To connect two trunk segments to a repeater, attach one end of each trunk segment directly to the repeater (as if the repeater were another workstation).

Figure 6-1
Thin-Ethernet Cable Network



Cabling a Thick-Ethernet Cable Network

If you plan to use only thick-Ethernet cable, install each trunk segment as explained below:

1. Place the stations and peripherals in their assigned locations, according to your network plan.

2. Install the transceivers according to the manufacturer's directions and your network plan.

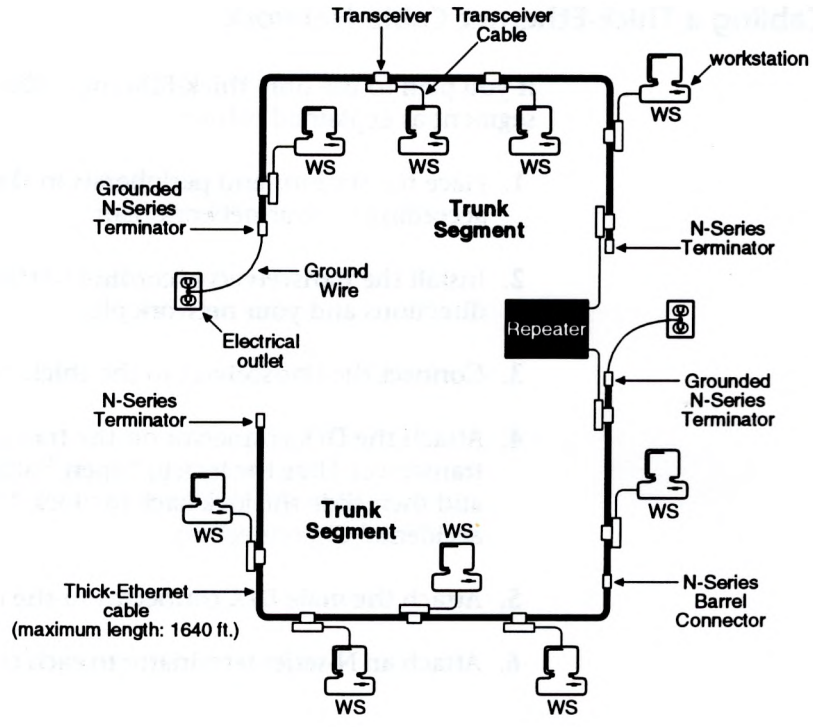
3. Connect the transceivers to the thick cable.

4. Attach the DIX connector on the transceiver cable to the transceiver. Slide the lock to "open," attach it to the transceiver, and then slide the lock back to "lock." The slide lock prevents accidental disconnection.

5. Attach the male DIX connector to the network board.

6. Attach an N-series terminator to each end of the trunk segment.

Figure 6-2
Attaching N-Series Terminators to Trunk Segments



7. Ground one of the two terminators by attaching the end of the grounding wire to an earth ground (the middle screw of an AC power outlet). If the grounding wire is too short to reach the outlet, use 16- or 18-gauge insulated wire to extend the grounding wire.

8. To join two trunk segments together, connect one end of each trunk segment to the same repeater. Trunk segments are connected to repeaters in the same way that they are connected to stations (by means of a transceiver and a transceiver cable).

Cabling a Thin/Thick-Cable Network

If you plan to use thin and thick cable in the same trunk segment, read the directions for thin and thick cabling sections. Be sure to follow the limits and rules that apply to your network layout.

Cabling a UTP-Cable Network

If you plan to use only UTP-Ethernet cabling, install the wiring as defined in Planning the Network by following the instructions below.

Cabling Guidelines

1. Place the network stations and peripherals in their assigned locations. Refer to the layout diagram prepared for the cable layout.

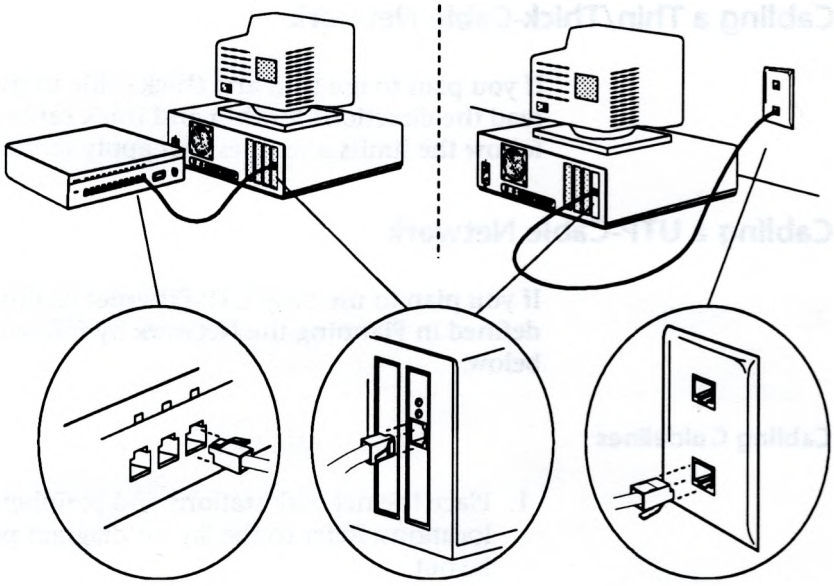
2. Attach an RJ-45 connector plug (located on either end of the UTP cable) to the connector jack on the network station.

3. Depending on your network layout, attach the RJ-45 connector plug at the other end of the cable to a jack on either the concentrator or on the UTP wall plug (as shown in Figure 6-3).

   Keep the cable at least 12 inches away from lights or power cables.

4. The quality of the connection between network stations can be determined by checking the link status light on the concentrator and each network station.

Figure 6-3
Cabling Separate Network Stations to a Concentrator or Wall Plate



Cabling a UTP/Thin/Thick-Cable Network

If you will be using a combination UTP/thin/thick-cable network, wire the UTP segment as described above then connect the UTP concentrator or hub to the thin and thick segments as explained in the combination thin/thick-cable network section.

Refer to chapter 7 Loading LAN Drivers for directions on loading LAN drivers.

chapter 7

Loading LAN Drivers

NE2000plus LAN Drivers

This chapter is a reference to LAN driver loading instructions according to the operating system you are using on your network. Refer to the appropriate documentation that came with your operating system. Italicized words refer to document names and names in parenthesis refer to sections in a document.

The NE2000plus can use the same drivers as the NE2000 and NE2000T network interface boards.

Multiple frame types can be loaded with client or server LAN drivers. Network stations including bridges, routers, print servers and workstations on the same network segment must use one of the same frame types as used on the server. If the frame types do not match, communication will not take place. One workstation on the segment can use a different frame type than another workstation as long as both frame types are loaded on the server.

Novell's drivers default to the 802.2 frame type. Workstation frame types for older drivers can be altered by using the NET.CFG file and frame types can be altered on servers when the LAN driver is loaded. Older drivers for servers and workstations default to the 802.3 Ethernet frame type.

Servers

NetWare v3.1x

See "Load LAN drivers and other loadable modules" and "Bind the protocol to the LAN driver" in *Installation.*

NetWare v2.2

See "The operating system generation module" in *Installing and Maintaining the Network.*

NetWare v2.1x

Depending on your version of NetWare, select and load the NE2000 LAN driver when you run either the NETGEN or ELSGEN utility.

Workstations

DOS ODI

See *ODI shells for DOS.*

OS/2

See *NetWare Requester for OS/2.*

Routers and Bridges

NetWare v3.1x

See "Installing and generating router software" in *Installation.*

NetWare v2.2

See "Run ROUTEGEN" in *Installing and Maintaining the Network.*

NetWare v2.1x

See *External Bridges Supplement.*

Refer to chapter 8 "Troubleshooting Hints" for general troubleshooting guidelines and Technical support information.

chapter 8

Troubleshooting Hints

Network Station Communication Problems

Possible Symptoms

- No status link light (valid only when using UTP).
- Abort Retry problems.

Possible Causes

- Bad cables or segments.
- Incorrectly configured LAN board.
- Incorrect timing settings.

Possible Solutions

- Check and replace cables if necessary.
- Verify correct configuration with configuration/diagnostics utility. Reconfigure if necessary.
- Replace the LAN board.
- Check the concentrator for a partitioned or disabled port if using UTP cabling.

Possible Symptoms

- No board found error message displayed when board is installed.

Possible Causes

- I/O conflict.
- Incorrectly installed LAN board.

Possible Solutions

- Reconfigure the board or other device so the conflict is eliminated.
- Reinstall the board.
- Replace the LAN board.

Memory addresses C000h and C400h conflict with VGA boards.

Port 360h conflicts with LPT2 when using shared memory.

Possible Symptoms

- System hangs when loading LAN driver.
- Video distortion.

Possible Causes

- Shared memory device conflict.
- Conflict with 8 bit shared RAM boards and 16 bit shared RAM boards.

Possible Solutions

- Replace the 8 bit shared memory device or remap it outside the C000:0h-DFFF:Fh range if possible.
- Remap the NE2000plus to use an Extended Option.
- If the Basic and Extended Options conflict with the current system setup, the NE2000plus should be run in programmed I/O mode.

If these hints do not help see the Technical Support section at the end of the chapter.

Microdyne Technical Support

Microdyne Corporation Technical Support is available from 7 a.m. to 5 p.m. (Pacific Time), Monday through Friday, excluding holidays.

Contact Information:

Microdyne Corporation
Technical Support
3601 Eisenhower Avenue
Alexandria, Virginia 22304 U.S.A.
Phone: (703) 329-3700

You can reach us at:

U.S. and Canada: (800)255-3967
International: (703) 960-9661

FAX: (703) 329-3721

BBS: (703) 960-9509
Baud Rate: 1200, 2400, 4800, or 9600
Parity: None
Word length: 8-bit
Stop bit: 1

Returning Defective Products

If you have a defective board contact Microdyne's Technical Support Group. They will verify that the board is defective then they will have the Microdyne's RMA department contact you to arrange a board replacement.

Addendum: LED Status Lights

Please note that there are six assemblies available for the NE2000*plus* family of Ethernet adapters. (All assembly numbers are clearly marked on the board.) The functionality remains the same for each version, although the size of the NE2000T*plus* has been reduced on the newer version.

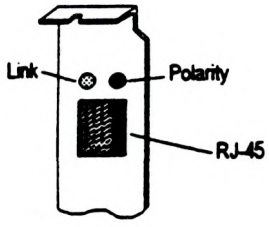
The assembly numbers available are:

NE2000*plus*-3	810-000228-001	NE2000*plus*-3	910-00018-001
NE2000*plus*	810-000228-002	NE2000*plus*	910-00018-002
NE2000T*plus*	810-000228-003	NE2000T*plus*	910-00019-001

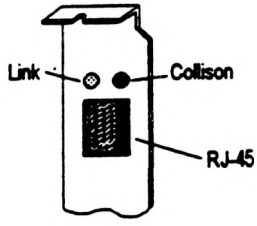
The LED status indicators are different depending on which version of the NE2000T*plus* or NE2000*plus*-3 you have. *LED status lights are only valid when using UTP cabling, and are not applicable on the NE2000plus coax card.* The LEDs on the 810 assemblies indicate link and polarity, and the LEDs on the 910 assemblies indicate link and collision. See diagram below for clarification.

NE2000T*plus* and NE2000*plus*-3
Status LED Indicators

810 assemblies



910 assemblies



LED Definition

Link	Indicates a valid 10Base-T connection is established
Polarity	Indicates the polarity is correct on the cable.
Collision	Indicates the detection of a collision on the network.

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